

# **SPECIFICATIONS INDEX**

GOVERNMENT OF THE VIRGIN ISLANDS, DEPARTMENT OF HEALTH

ELDRA SHULTERBRANDT ANNEX FACILITY

**GRANT NO. D12AP00350 (VI-CIP-2012-4)**

St. Thomas, U. S. Virgin Islands

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## **DIVISION 22 – PLUMBING**



**SECTION 22 05 17 – SLEEVES, SEALS FOR PLUMBING PIPING**  
**DEPARTMENT OF HEALTH: ELDRA SHULTERBRANDT ANNEX FACILITY**  
**GRANT NO. D12AP00350 (VI-CIP-2012-4)**  
**St. Thomas, U. S. Virgin Islands**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 SLEEVES**

- A. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

**2.2 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

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1. Sealing Elements: EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Plastic.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

**2.3 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.
  1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
  2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

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3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Div 07.

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel wall sleeves.
    - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel wall sleeves.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
  3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves with sleeve-seal system.

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- 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves with sleeve-seal system.
    - 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
  - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
  - a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
  - b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION**

**SECTION 22 05 18 – ESCUTCHEONS FOR PLUMBING PIPING**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

**2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:

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- a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
  - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
  - c. Insulated Piping: One-piece, stamped-steel type.
  - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
  - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
  - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
  - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
  - i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
  - j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
  - k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping: One-piece, floor-plate type.

**3.2 FIELD QUALITY CONTROL**

- A. Replace broken and damaged escutcheons and floor plates using new materials.

**END OF SECTION**



**SECTION 22 05 19 – METERS AND GAGES FOR PLUMBING PIPING**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Product certificates.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS**

**2.1 LIQUID-IN-GLASS THERMOMETERS**

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following):
    - a. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.200.
  - 3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated.
  - 4. Case Form: Adjustable angle unless otherwise indicated.
  - 5. Tube: Glass with magnifying lens and blue or red organic liquid.
  - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F (deg C).
  - 7. Window: Glass.
  - 8. Stem: Aluminum and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  - 9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.

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10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## **2.2 THERMOWELLS**

### **A. Thermowells:**

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES and CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### **B. Heat-Transfer Medium: Mixture of graphite and glycerin.**

## **2.3 PRESSURE GAGES**

### **A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Terice, H. O. Co.
  - b. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - c. Weiss Instruments, Inc.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi (kPa).
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

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12. e range.

**2.4 GAGE ATTACHMENTS**

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install thermometers in the following locations:
  - 1. Outlet of each water heater.
- I. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each pressure-reducing valve.
  - 3. Suction and discharge of each domestic water pump.
- J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- K. Adjust faces of meters and gages to proper angle for best visibility.

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**3.2 THERMOMETER SCHEDULE**

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
  - 1. Industrial-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

**3.3 THERMOMETER SCALE-RANGE SCHEDULE**

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F (Minus 20 to plus 50 deg C).
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

**3.4 PRESSURE-GAGE SCHEDULE**

- A. Pressure gages at discharge of each water service into building shall be the following:
  - 1. Liquid-filled, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
  - 1. Liquid-filled, direct-mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
  - 1. Liquid-filled direct-mounted, metal case.

**3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Water Service Piping: 0 to 100 psi (0 to 600 kPa).
- B. Scale Range for Domestic Water Piping: 0 to 100 psi (0 to 600 kPa).

**END OF SECTION**

**SECTION 22 05 23 – GENERAL-DUTY VALVES FOR PLUMBING PIPING**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.
4. Bronze gate valves.
5. Iron gate valves.
6. Bronze globe valves.

B. Related Sections:

1. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Section 22 11 16 "Domestic Water Piping" for valves applicable only to this piping.
3. Section 22 13 19 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of valve indicated.

**1.3 QUALITY ASSURANCE**

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
1. Gate Valves: With rising stem.

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2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

## **2.2 BRASS BALL VALVES**

A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Hammond Valve.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig (1035 kPa).
  - c. CWP Rating: 600 psig (4140 kPa).
  - d. Body Design: Two piece.
  - e. Body Material: Forged brass.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Brass.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.

## **2.3 BRONZE BALL VALVES**

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Hammond Valve.
  - c. NIBCO INC.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

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2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig (1035 kPa).
  - c. CWP Rating: 600 psig (4140 kPa).
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Bronze.
  - i. Ball: Chrome-plated brass.
  - j. Port: Full.

**2.4 BRONZE SWING CHECK VALVES**

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane Co.; Crane Valve Group; Jenkins Valves.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - f. Zy-Tech Global Industries, Inc.
  2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.

**2.5 BRONZE GATE VALVES**

- A. Class 125, RS Bronze Gate Valves:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Jenkins Valves.
    - b. Hammond Valve.
    - c. NIBCO INC.
  2. Description:

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- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig (1380 kPa).
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem: Bronze.
- f. Disc: Solid wedge; bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

**PART 3 - EXECUTION**

**3.1 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

**3.2 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

**3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, butterfly, or gate valves.
  - 2. Throttling Service: ball, or butterfly valves.
  - 3. Pump-Discharge Check Valves:
    - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
    - b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.



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3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.

**3.4 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE**

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: One piece, full, brass trim.
4. Bronze Swing Check Valves: , bronze disc.
5. Bronze Gate Valves: Class 125, NRS.
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
2. Iron Swing Check Valves: Class 125, metal seats.
3. Iron Gate Valves: Class 125, OS&Y.
4. Iron Globe Valves: Class 125.

**END OF SECTION**



**SECTION 22 05 29 – HANGERS, SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**  
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**GRANT NO. D12AP00350 (VI-CIP-2012-4)**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Pipe positioning systems.
  - 6. Equipment supports.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
  - 1. Trapeze pipe hangers.
  - 2. Equipment supports.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

**1.5 QUALITY ASSURANCE**

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

**PART 2 - PRODUCTS**

**2.1 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:

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1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized.

**B. Copper Pipe Hangers:**

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

**2.2 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

**2.3 FASTENER SYSTEMS**

- A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

**2.4 PIPE POSITIONING SYSTEMS**

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

**2.5 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

**2.6 MISCELLANEOUS MATERIALS**

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

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**PART 3 - EXECUTION**

**3.1 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

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L. Insulated Piping:

1. Attach clamps and spacers to piping.
  - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
  - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
  - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
  - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
  - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
  - d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
  - e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
5. Pipes NPS 8 (DN 200) and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

**3.2 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

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- C. Provide lateral bracing, to prevent swaying, for equipment supports.

**3.3 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

**3.4 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

**3.5 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Div 09.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**3.6 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

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- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
  - 4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
  - 5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
  - 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
  - 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
  - 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
  - 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:



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1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

**END OF SECTION**

**SECTION 22 05 53 – IDENTIFICATION FOR PLUMBING PIPING**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.

**1.2 ACTION SUBMITTAL**

- A. Product Data: For each type of product indicated.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT LABELS**

- A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
  2. Letter Color: White.
  3. Background Color: Black.
  4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
  6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the

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Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

**2.2 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Black or Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
- F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

**2.3 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches (38 mm) high.

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**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

**3.2 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

**3.3 PIPE LABEL INSTALLATION**

- A. Piping Color-Coding: Painting of piping is specified in Div. 09.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  - 1. Domestic Water Piping:
    - a. Background Color: Blue.
    - b. Letter Color: White.
  - 2. Sanitary Waste and Storm Drainage Piping:
    - a. Background Color: Black.
    - b. Letter Color: White.

**END OF SECTION**



**SECTION 22 07 19 – PLUMBING PIPING INSULATION**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  2. Detail insulation application at pipe expansion joints for each type of insulation.
  3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  4. Detail removable insulation at piping specialties, equipment connections, and access panels.
  5. Detail application of field-applied jackets.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.4 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

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- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule".
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
- a. Johns Manville; Micro-Lok.
  - b. Knauf Insulation; 1000-Degree Pipe Insulation.
  - c. Manson Insulation Inc.; Alley-K.
  - d. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### **2.2 INSULATING CEMENTS**

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

### **2.3 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.



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1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    - d. Mon-Eco Industries, Inc.; 22-25.
    - e. .
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.

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- d. Speedline Corporation; Polyco VP Adhesive.
- 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## **2.4 MASTICS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.

## **2.5 FIELD-APPLIED JACKETS**

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Johns Manville; Zeston.

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- b. P.I.C. Plastics, Inc.; FG Series.
  - c. Proto Corporation; LoSmoke.
  - d. Speedline Corporation; SmokeSafe.
- 2. Adhesive: As recommended by jacket material manufacturer.
- 3. Color: White
- 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
  - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## **2.6 TAPES**

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

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- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.

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- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### **3.3 PENETRATIONS**

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

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3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Div 07.

### **3.4 GENERAL PIPE INSULATION INSTALLATION**

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and

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- irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
  6. surface being insulated.

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**3.5      INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION**

A.      Insulation Installation on Straight Pipes and Tubes:

1.      Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2.      Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3.      For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4.      For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B.      Insulation Installation on Pipe Flanges:

1.      Install preformed pipe insulation to outer diameter of pipe flange.
2.      Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3.      Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4.      Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C.      Insulation Installation on Pipe Fittings and Elbows:

1.      Install preformed sections of same material as straight segments of pipe insulation when available.
2.      When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D.      Insulation Installation on Valves and Pipe Specialties:

1.      Install preformed sections of same material as straight segments of pipe insulation when available.
2.      When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3.      Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4.      Install insulation to flanges as specified for flange insulation application.

**3.6      FIELD-APPLIED JACKET INSTALLATION**

A.      Where FSK jackets are indicated, install as follows:



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1. Draw jacket material smooth and tight.
  2. Install lap or joint strips with same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

### **3.7 FINISHES**

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### **3.8 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their

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installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

**3.9 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

**3.10 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:
  - 1. Flexible Elastomeric: 3/4 inch (19 mm) thick.
  - 2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

**END OF SECTION**

**SECTION 22 10 10 - GAS PIPING**  
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**PART 1      GENERAL**

**1.1          SECTION INCLUDES**

- A.      Gas piping.

**1.2          REFERENCES**

- A.      ASTM A53 - Specification for Pipe, Steel, Black and Hot-dipped, Zinc Coated Welded and Seamless.

**1.3          QUALITY ASSURANCE**

- A.      Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:
  - 1.      ASME
  - 2.      ASTM
  - 3.      NEMA
  - 4.      UL
  - 5.      CSA

**1.4          SUBMITTALS**

- A.      Include data on pipe materials, pipe fittings, valves and accessories.
- B.      Submit manufacturer's installation instructions.

**1.5          DELIVERY, STORAGE AND HANDLING**

- A.      Deliver products to site under provisions of Section 01663 - Product Delivery, Storage and Handling Requirements.
- B.      Store and protect products under provisions of Section 01663 - Product Delivery, Storage and Handling Requirements.
- C.      Deliver and store valves in shipping containers with labeling in place.

**PART 2      PRODUCTS**

**2.1          ACCEPTABLE MANUFACTURERS - FERROUS PIPING**

- A.      Tyler (Tyler, TX).
- B.      Charlotte Pipe & Foundry Company (Charlotte, NC).
- C.      AB&I Foundry (Oakland, CA).

**2.2          GAS PIPING**

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- A. Steel Pipe (Above Grade/Building Exterior): ASTM A53, Schedule 40 Hot-Dipped Zinc Coated (Galvanized).
  - 1. Fittings: ANSI/ASME B16.3, malleable iron or ASTM A 234, forged steel welding type.
  - 2. Joints:
    - (a) Screwed for pipe 2 inches and under.
    - (b) ANSI/AWS D1.1, welded for pipe over 2 inches.
- B. Steel Pipe (Above Grade/Building Interior): ASTM A53, Schedule 40 black.
  - 1. Fittings: ANSI/ASME B16.3, malleable iron or ASTM A 234, forged steel welding type.
  - 2. Joints:
    - (a) Screwed for pipe 2 inches and under.
    - (b) ANSI/AWS D1.1, welded for pipe over 2 inches.

**PART 3 EXECUTION**

**3.1 PREPARATION**

- A. Ream pipe and tube ends where applicable and remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

**3.2 INSTALLATION**

- A. Route piping in orderly manner and maintain gradient.
- B. Provide clearance for installation of insulation and access to valves and fittings.
- C. The gas system piping installed above grade shall be fabricated of ASTM A53 or A120, Schedule 40 black steel pipe.
- D. Provide gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 2 PSIG. Provide regulators on each line serving the gas appliances and sized in accordance with the equipment.
- E. Encase underground gas supply piping located under the building concrete slab in a Schedule 40 PVC pipe sleeve sealed at one end and vented to the outside on the other end. Sleeve should be at least two to three times larger than the carrier pipe.
- F. Gas supply piping penetrating any exterior or fire rated wall shall be sealed with UL listed fire resistant materials.

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- G. Propane shall furnish the LP tank Vendor and be responsible for installing it.
- H. For LP tanks installed underground, the Contractor shall be responsible for completing filling the tanks with liquid propane immediately after installation is completed by the Propane Vendor.
- I. The kitchen be shall be provided with gas-fired cooking equipment under the hood, gas service to the cooking equipment shall only be shutdown when the hood fire suppression is activated and not by the fire alarm system.
- J. Provide plug valves in gas systems for shutoff purposes.

**END OF SECTION**



**SECTION 22 11 16 – DOMESTIC WATER PIPING**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For transition fittings and dielectric fittings.

**1.3 INFORMATIONAL SUBMITTALS**

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

**PART 2 - PRODUCTS**

**2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

**2.2 CPVC PIPING**

- A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40.
  - 1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
  - 2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.
- B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.
- C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

**2.3 PVC PIPE AND FITTINGS**

- A. PVC Pipe: ASTM D 1785, Schedule 40.
- B. PVC Socket Fittings: ASTM D 2466 for Schedule 40.

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**2.4 PIPING JOINING MATERIALS**

- A. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
  - 1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

**2.5 TRANSITION FITTINGS**

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

**2.6 DIELECTRIC FITTINGS**

General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined



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**PART 3 - EXECUTION**

**3.1 EARTHWORK**

- A. Comply with requirements in Div 31 for excavating, trenching, and backfilling.

**3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping Specialties."
- C. Install shutoff valve immediately upstream of each dielectric fitting.
- D. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 22 11 19 "Domestic Water Piping Specialties."
- E. Install domestic water piping level without pitch and plumb.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- H. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- J. Install piping to permit valve servicing.
- K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- L. Install piping free of sags and bends.

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- M. Install fittings for changes in direction and branch connections.
- N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- O. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- P. Install thermostats in hot-water circulation piping.
- Q. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

**3.3 JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

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1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

- F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### **3.4 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger, support products, and installation in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
1. Vertical Piping: MSS Type 8 or 42, clamps.
  2. Individual, Straight, Horizontal Piping Runs:
- B. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### **3.5 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

### **3.6 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

### **3.7 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:

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1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
  - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

### **3.8 ADJUSTING**

A. Perform the following adjustments before operation:

- 1. Close drain valves, hydrants, and hose bibbs.

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2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
  - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.9 CLEANING**

- A. Clean and disinfect potable domestic water piping as follows:
  1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

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**3.10 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
  - 1. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
- E. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
  - 1. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.
  - 2. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints. NPS 1-1/2 (DN 40) and NPS 2 (DN 50) CPVC pipe with CPVC socket fittings may be used instead of tubing.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be **(one of)** the following:
  - 1. CPVC, Schedule 40; socket fittings; and solvent-cemented joints.

**END OF SECTION**

**SECTION 22 11 19 – DOMESTIC WATER PIPING SPECIALTIES**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Trap-seal primer valves.

B. Related Requirements:

1. Section 22 05 19 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 22 11 16 "Domestic Water Piping" for water meters.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

**2.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

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**2.3 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Standard: ASSE 1001.
  - 2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
  - 3. Body: Bronze.
  - 4. Inlet and Outlet Connections: Threaded.
  - 5. Finish: Rough bronze.
- B. Hose-Connection Vacuum Breakers:
  - 1. Standard: ASSE 1011.
  - 2. Body: Bronze, nonremovable, with manual drain.
  - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  - 4. Finish: Chrome or nickel plated.

**2.4 BACKFLOW PREVENTERS**

- A. Intermediate Atmospheric-Vent Backflow Preventers:
  - 1. Standard: ASSE 1012.
  - 2. Operation: Continuous-pressure applications.
  - 3. Body: Bronze.
  - 4. End Connections: Solder joint.
  - 5. Finish: Rough bronze.

**2.5 BALANCING VALVES**

- A. Memory-Stop Balancing Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - 2. available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Milwaukee Valve Company.
    - c. NIBCO Inc.
  - 3. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  - 4. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
  - 5. Size: NPS 2 (DN 50) or smaller.
  - 6. Body: Copper alloy.
  - 7. Port: Standard or full port.
  - 8. Ball: Chrome-plated brass.
  - 9. Seats and Seals: Replaceable.
  - 10. End Connections: Solder joint or threaded.



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11. Handle: Vinyl-covered steel with memory-setting device.

**2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES**

- A. Primary, Thermostatic, Water Mixing Valves :
  1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Leonard Valve Company.
    - b. Powers; a division of Watts Water Technologies, Inc.
    - c. Symmons Industries, Inc.
  2. Standard: ASSE 1017.
  3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.

**2.7 HOSE BIBBS**

- A. Hose Bibbs :
  1. Standard: ASME A112.18.1 for sediment faucets.
  2. Body Material: Bronze.
  3. Seat: Bronze, replaceable.
  4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
  5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
  6. Pressure Rating: 125 psig (860 kPa).
  7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

**2.8 WALL HYDRANTS**

- A. Nonfreeze Wall Hydrants:
  1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
  2. Pressure Rating: 125 psig (860 kPa).
  3. Operation: Loose key.
  4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
  5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
  6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
  7. Box: Deep, flush mounted with cover.
  8. Box and Cover Finish: Chrome plated.
  9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
  10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
  11. Operating Keys(s): Two with each wall hydrant.

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**2.9 DRAIN VALVES**

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

**2.10 WATER-HAMMER ARRESTERS**

A. Water-Hammer Arresters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Precision Plumbing Products, Inc.
  - b. Sioux Chief Manufacturing Company, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

**2.11 TRAP-SEAL PRIMER DEVICE**

A. Supply-Type, Trap-Seal Primer Device :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Precision Plumbing Products, Inc.
  - b. Sioux Chief Manufacturing Company, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig (860 kPa) minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

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**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  - 1. Locate backflow preventers in same room as connected equipment or system.
  - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
  - 3. Do not install bypass piping around backflow preventers.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each solenoid valve and pump.
- E. Install water-hammer arresters in water piping according to PDI-WH 201.
- F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

**3.2 CONNECTIONS**

- A. Comply with requirements for ground equipment in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

**3.3 FIELD QUALITY CONTROL**

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

**3.4 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.

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- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

**END OF SECTION**

**SECTION 22 13 16 – SANITARY WASTE AND VENT PIPING**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.4 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

**PART 2 - PRODUCTS**

**2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

**2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service or extra heavy weight. Pipe and fitting shall be marked with the collective trademark.
- B. Gaskets: ASTM C 564, rubber.

**2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. Pipe and fitting shall be marked with the collective trade mark.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cast Iron Soil Pipe Institute.

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- b. Matco-Norca, Inc.
  - c. Tyler Pipe.
  - d. Charlotte Piping Company.
- 2. Standards: ASTM C 1277 and CISPI 310.
- 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cast Iron Soil Pipe Institute.
    - b. Tyler Pipe.
    - c. Charlotte Piping Company.
  - 2. Standards: ASTM C 1277 and ASTM C 1540.
  - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

**2.4 COPPER TUBE AND FITTINGS**

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

**2.5 ABS PIPE AND FITTINGS**

- A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.
- B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- C. Solvent Cement: ASTM D 2235.
  - 1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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**2.6 PVC PIPE AND FITTINGS**

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
  - 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
  - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**2.7 SPECIALTY PIPE FITTINGS**

- A. Transition Couplings:
  - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
  - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 3. Shielded, Nonpressure Transition Couplings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Fernco Inc.
    - b. Standard: ASTM C 1173.
    - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - d. Sleeve Materials:
      - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

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**PART 3 - EXECUTION**

**3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Div 31.

**3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:



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1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 (DN 50) and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 80) and larger.
  2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- M. Install aboveground ABS piping according to ASTM D 2661.
- N. Install underground ABS and PVC piping according to ASTM D 2321.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

### **3.3 JOINT CONSTRUCTION**

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- E. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

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2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

**3.4 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
  1. Install transition couplings at joints of piping with small differences in OD's.
  2. In Drainage Piping: Shielded, nonpressure transition couplings.

**3.5 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting(, **valve**,) and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
- F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
- H. Install supports for vertical copper tubing every 10 feet (3 m).
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

**3.6 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

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**3.7 IDENTIFICATION**

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

**3.8 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

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**3.9 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

**3.10 PIPING SCHEDULE**

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
  - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
  - 1.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 4. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:
  - 1.
  - 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  - 4. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
  - 5. Copper DWV tube, copper drainage fittings, and soldered joints.
- E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
  - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
  - 3. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
  - 4. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:

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1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
3. Solid wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

**END OF SECTION**



**SECTION 22 13 19 – SANITARY WASTE PIPING SPECIALTIES**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous sanitary drainage piping specialties.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

**1.3 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.1 CLEANOUTS**

- A. Exposed Cast-Iron Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

- B. Cast-Iron Floor Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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- a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
  - 3. Size: Same as connected branch.
  - 4. Type: Threaded, adjustable housing.
  - 5. Body or Ferrule: Cast iron.
  - 6. Clamping Device: Required.
  - 7. Outlet Connection: Spigot.
  - 8. Closure: Brass plug with straight threads and gasket.
  - 9. Adjustable Housing Material: Cast iron with.
  - 10. Frame and Cover Shape: Round.
  - 11. Top Loading Classification: Extra Heavy Duty.
  - 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts :

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Zurn Plumbing Products Group; Specification Drainage Operation.
- 2. Standard: ASME A112.36.2M. Include wall access.
- 3. Size: Same as connected drainage piping.
- 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 5. Closure: Countersunk, plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Wall Access: Round, stainless-steel cover plate with screw.
- 8. Wall Access: Round, stainless-steel wall-installation frame and cover.

## **2.2 FLOOR DRAINS**

A. Cast-Iron Floor Drains:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Josam Company; Josam Div.
  - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - c. Zurn Plumbing Products Group; Specification Drainage Operation.



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- d. Wade Inc.
- 3. Standard: ASME A112.6.3.
- 4. Top Shape: Round.
- 5. Trap Material: Cast iron.
- 6. Trap Pattern: P-trap.

**2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES**

A. Open Drains :

- 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
- 2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Floor-Drain, Trap-Seal Primer Fittings :

- 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
- 2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

C. Air-Gap Fittings :

- 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
- 2. Body: Bronze or cast iron.
- 3. Inlet: Opening in top of body.
- 4. Outlet: Same as inlet.
- 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  - 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate at each change in direction of piping greater than 45 degrees.
  - 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
  - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

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- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
    - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
    - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.
- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- L. Install vent caps on each vent pipe passing through roof.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

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**3.2 CONNECTIONS**

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

**3.3 FLASHING INSTALLATION**

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Div 07 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

**3.4 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

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**3.5 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION**

**SECTION 22 33 00 – GAS-FIRED, DOMESTIC-WATER HEATERS**  
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**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Commercial, light-duty, storage, gas fired, domestic-water heaters.
2. Domestic-water heater accessories.

**1.2 ACTION SUBMITTALS**

A. Product Data: For each type and size of domestic-water heater indicated.

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1, Section 7, "Service Water Heating."

C. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

**1.3 INFORMATIONAL SUBMITTALS**

- A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- B. Source quality-control reports.
- C. Field quality-control reports.
- D. Warranty: Sample of special warranty.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and maintenance data.

**1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

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- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

**1.6 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Periods: From date of Substantial Completion.
    - a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:
      - 1) Storage Tank: Five years.
      - 2) Controls and Other Components: Five years.

**PART 2 - PRODUCTS**

**2.1 HIGH EFFICIENCY COMMERCIAL GAS-FIRED WATER HEATER**

- A. Heater: High efficiency condensing water heater with a minimum thermal efficiency of 98 percent. Heater shall be capable of operating lime scale free without the use of annual de-liming or the use of de-liming solution, and full modulation firing down to 20 percent of the rated input with a turndown ration of 5:1. Tube to terminate into a one piece glass lined cast iron header without banding material, bolts, gaskets or "O" rings in the header configuration. Heater shall be provided with front access to the heater exchanger for inspection, cleaning or repair purposes; burner/flare observation port; heat exchanger mounted in a stress-free jacket assembly in order to provide "free floating design" able to withstand the effects of thermal shock; and be capable of operating on natural or propane gas with a minimum recovery rate of 70 Degree F temperature rise. Heat exchanger shall be equipped with an outlet thermometer to monitor discharge water temperature. The stainless steel combustion chamber shall be sealed, completely enclosed with ceramic fiberboard insulation, independent of the outer jacket assembly, and designed to drain condensation to the bottom of the heat exchanger assembly. The burners shall be a premix design, constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates, and be capable of firing on a horizontal plane. The gas valve shall be designed with a negative pressure regulation and be equipped with a variable speed blower system to precisely control the fuel/air mixture in order to provide modulating firing rates for maximum efficiency. Heater shall operate in a safe condition at a de-rated output with gas supply pressures as low as 4 Inches WC. All components shall be easily accessed and serviceable from the front and top of the jacket. Heater

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shall be provided with a separate storage tank, all bronze storage tank circulating pump, flow switch, high limit temperature control, inlet and outlet water temperature sensors, flue temperature sensor, contacts on any failure, runtime contacts alarm contacts, bear the ASME "H" stamp, National Board listed for 160 PSIG maximum working pressure and be CSA listed. Capacity and electrical characteristics shall be as indicated on plans. Heater shall be Lochinvar "Armor" or approved equal.

- B. Storage Tank: Welded steel tank constructed in accordance with ASME Section VIII for 125 PSIG maximum working pressure, contain an inspection port and thermally insulated with a minimum of 2 inch thick high density polyurethane R-16 foam insulation meeting the requirements of the latest edition of ASHRAE 90.1. Tank shall be constructed with a heavy gauge galvanized steel jacket assembly finished with acrylic enamel, glass lined tank interior, and provided with a properly sized temperature and pressure relief valve. Tank shall be constructed with a baffled inlet designed to receive all circulation from the water heater and eliminate turbulence in the tank. The baffled tank shall supply 80 percent of the tank capacity without a drop in outlet temperature regardless of rate of draw.
- C. Controls: Standard control system shall include a 2-line, 16 character backlit LCD display, password security, pump delay and pump exercise/PC port connection. Heater shall allow 0-10 VDC input connection for the school wide TAC-Andover Energy Management/Security (EM/S) System and have builtin "Cascade" to sequence and rotate while maintaining modulation. The manufacture shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping. A quality test report shall be shipped with each unit.
- D. Venting: Direct vent system with preferred sidewall termination of both the vent and combustion air. The flue shall be fabricated of CPVC sealed vent material
- E. Safety Controls: Provide with a factory wired high temperature cutoff, flue temperature sensor, flow switch and an ASME certified temperature and pressure relief valve.
- F. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode rod and temperature and pressure relief valve.
- G. Heater Certification: Heater shall be sized and listed by CSA International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the U.S. for operation at 140 Degree F and shall comply with the energy efficiency requirements of the latest edition of ASHRAE 90.1.
- H. Warranty: Furnish 5 year limited warranty.

## **2.2 DOMESTIC-WATER HEATER ACCESSORIES**

- A. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

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- B. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- (172.5-kPa-) maximum outlet pressure unless otherwise indicated.
- C. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- D. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domestic-water heater working-pressure rating.
- E. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- F. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- G. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

### **2.3 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test **commercial** domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 DOMESTIC-WATER HEATER INSTALLATION**

- A. Commercial, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base.
  - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
  - 2. Maintain manufacturer's recommended clearances.
  - 3. Arrange units so controls and devices that require servicing are accessible.
  - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 7. Anchor domestic-water heaters to substrate.



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- B. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- C. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for, domestic-water heaters that do not have tank drains. Fill domestic-water heaters with water.
- D. Charge domestic-water compression tanks with air.

**3.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

**3.3 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

**3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- B. Prepare test and inspection reports.

**END OF SECTION**



**SECTION 22 40 00 – PLUMBING FIXTURES**  
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**PART 1 - GENERAL**

**1.1 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.2 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

**1.3 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data

**PART 2 - PRODUCTS**

**2.1 PLUMBING FIXTURES**

- 1. For plumbing fixtures refer to schedules on drawings.

**2.2 SUPPLY FITTINGS**

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.
- F. Risers:
  - 1. NPS 1/2 (DN 15)
  - 2. Chrome-plated, rigid-copper pipe ASME A112.18.6.
  - 3. brass trap and swivel elbow with 0.032-inch- (0.83-mm-) ; and chrome-plated brass.

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**PART 3 - EXECUTION**

**3.1 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

**3.2 ADJUSTING**

- A. Operate and adjust fixtures and controls.

**3.3 CLEANING AND PROTECTION**

- A. Clean fixtures, faucets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed, sinks and fittings.
- C. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.
- D. After completing installation of fixtures, inspect and repair damaged finishes.

**END OF SECTION**